cypress

An Open Source Clinical Quality Measure Testing and Certification Tool

Health in the 21st Century

MITRE

Approved for Public Release: 12-4786

Goals

- Proposed to be the rigorous and repeatable testing tool of Electronic Health Records (EHRs) and EHR modules in calculating Meaningful Use (MU) Stage 2 Clinical Quality Measures (CQMs)
- CQM certification criteria addressed by Cypress include:
  - Capture and Export – the capability of EHR technology to create a data file that can be incorporated by another EHR technology which could be used to calculate CQMs
  - Import and Calculate – the capability of EHR technology to incorporate data (from another EHR technology where necessary) and correctly calculate the result for CQMs
  - Electronic Submission – the capability of EHR technology to create a standard data file that can be electronically accepted by the Centers for Medicare and Medicaid Services (CMS)

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Test Capabilities

- Cypress v2 provides 4 tests in support of CQM certification:
  1. Extensible Markup Language (XML) Data conformance testing of the Quality Reporting Document Architecture (QRDA) **Category 1** standard for individual patient-level data used for CQM calculation
  2. XML Data conformance testing of the QRDA **Category 3** standard for aggregate reporting of CQM calculation
  3. Accuracy calculation testing of the Meaningful Use Stage 2 Eligible Provider (**EP**) CQMs
  4. Accuracy calculation testing of the Meaningful Use Stage 2 Eligible Hospital (**EH**) CQMs

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Intended Users

- Authorized Testing Labs (ATLs)
- Planned to serve as the official testing tool for the 2014 EHR Certification program supported by the Office of the National Coordinator for Health IT (ONC)
- Cypress is open source and freely available for use or adoption by the health IT community, including EHR vendors and authorized testing labs
  - Any EHR vendor may use Cypress to pre-test software packages for certification readiness
  - EHR vendors will have access to not only the Cypress service, but also the underlying source code
  - Provides transparency and accessibility to the underlying Cypress software for federal stakeholders

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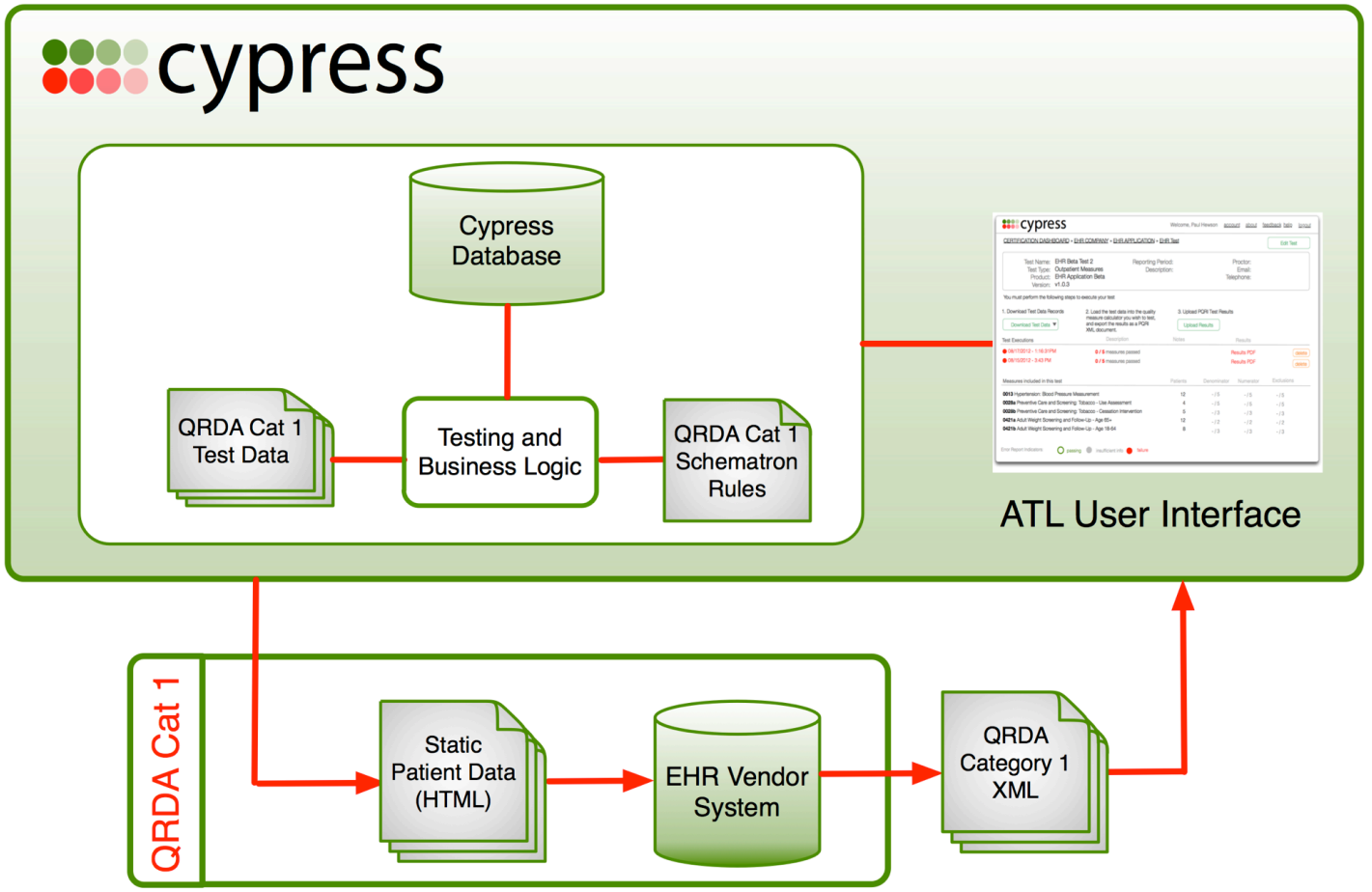
Concept of Operations
Capture and Export



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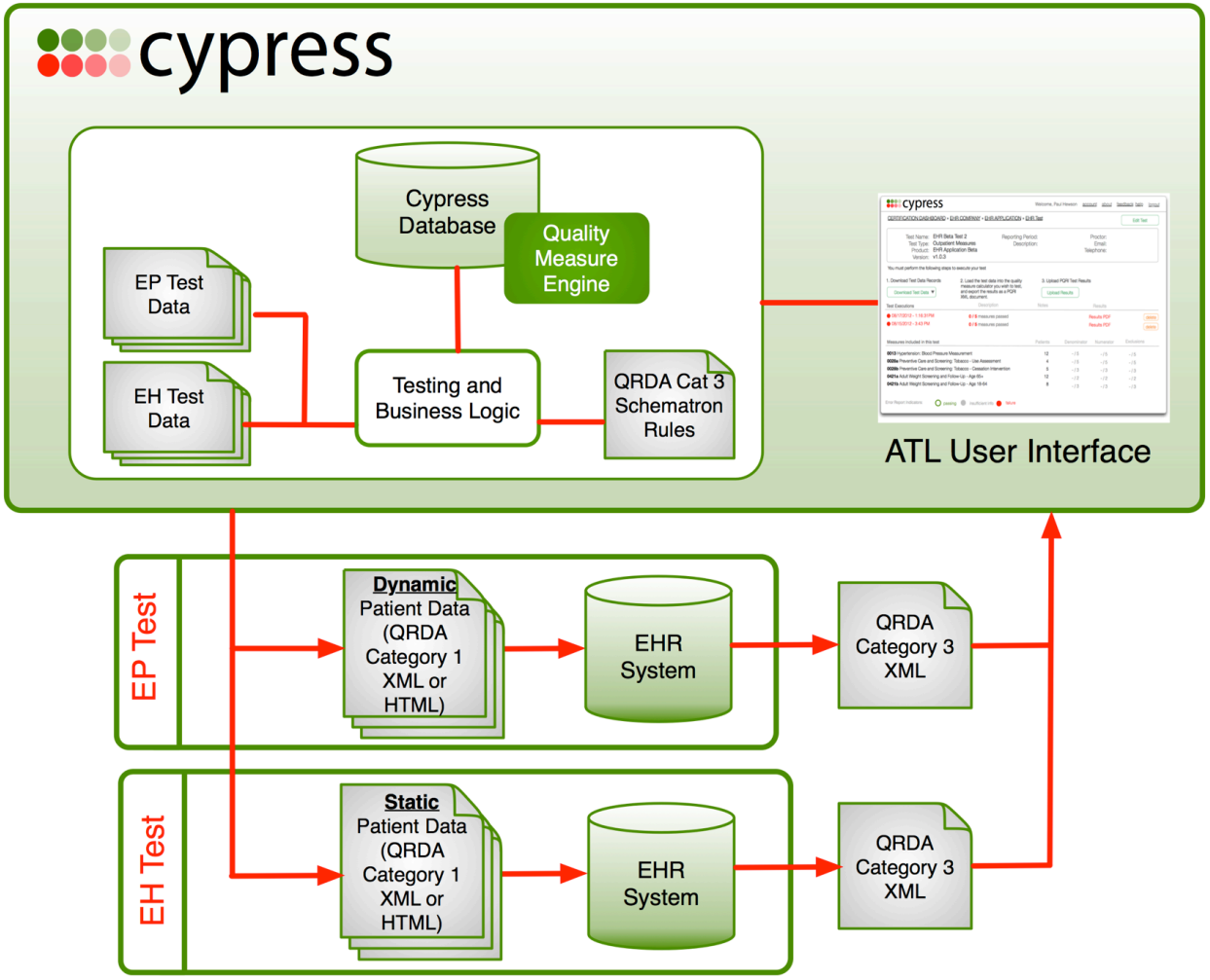
Concept of Operations
Import, Calculate, Electronic Submission



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Cypress v2 ATL Test Proctor Workflow

- Test Proctor will be the sole user to interact with Cypress v2 interface
- Test Proctor will work with EHR vendor (possibly remotely, possibly face-to-face) to identify CQMs to be tested under the various testing modes
- Test Proctor will provide all Cypress patient test inputs to EHR vendor
- Test Proctor will be responsible for overseeing the EHR vendor's capture/import/export during the test
- Test Proctor will be responsible for uploading any artifacts from the EHR into Cypress
  - QRDA Category 1 XML
  - QRDA Category 3 XML
- To Be Determined (TBD) - Federal stakeholder policy decision whether the ATL Test Proctor will have the ability to "manually override" Cypress test results in the Cypress tool

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What is a Passing Grade in Cypress?

- For QRDA Category 1 and Category 3 Schematron validation:
  - Any errors constitute a failure
  - Any warnings constitute a warning
  - Cypress will highlight where in the XML the Schematron errors and warnings were encountered to allow EHR vendor to fix software issue in their product
- For CQM accuracy calculation:
  - EHR vendors will have to have the exact summary CQM results in QRDA Category 3 XML
    - For example, if the CQM expected 2 patients in numerator and 5 in denominator, then any value other than 2/5 will constitute a failure
    - Cypress will be able to provide the full details of the patients that were expected for the 2 numerator results and 5 denominator results to allow an EHR vendor to either dispute the result or to fix software issue in their product

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Cypress v2 Certification Test Data Overview

- **Expected results for a set of known patients - Authoritative**
  - Conformance with standards and accuracy of CQM calculation
- **Maximum confidence from minimum data entry**
  - Minimize vendors' manual data entry burden
- **3 Cypress test decks include:**
  - QRDA Category 1 Test Data for verifying conformance with the QRDA Category 1 standard
  - EP CQM Test Data for certification testing of accurate calculation of EP measures
  - EH CQM Test Data for certification testing of accurate calculation of EH measures
- **Certification is a spot check of vendor performance – *not* an exhaustive test**

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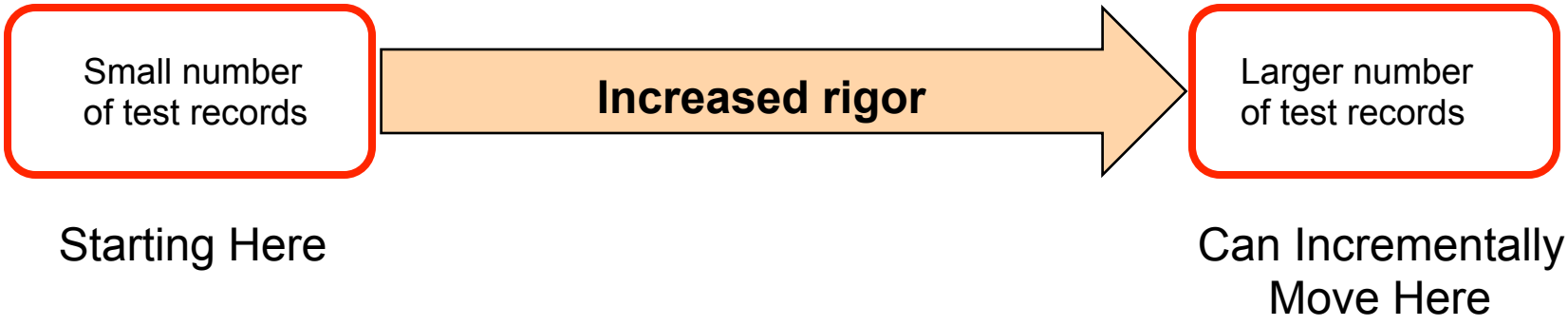
Cypress v2 Patient Test Data

- Level of confidence in accuracy of CQM calculations
  - Support manual entry of test records by vendors
  - Support future capability for automated import of test data
  - MITRE is working to balance EHR manual entry burden with rigor in exercising various logical paths through CQMs



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Cypress v2 Patient Test Data

- How long will it take to test an EHR vendor with Cypress?
  - Currently an unknown, and will be valuable information to collect in beta pilots in early Dec 2012 with ATL and EHR vendors
- Manual Data Entry
  - Time to load patient data dependent on the number of CQMs that the EHR vendors wants to be certified for
  - Estimate to fully test all 64 of the EP CQMs and all 29 EH CQMs for both QRDA Validation and CQM Calculation Accuracy is approximately 2 days for manual data entry of the approximately 200 patient records
  - Fully automated import of Cypress patient data will radically reduce this time to a few minutes

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QRDA Category 1 and 3 Validation

- MITRE is integrating testing files developed by a contractor into Cypress v2
  - Schematron XML validation rules
  - Errors cause failure
  - Warnings are notified to ATL user, but do not fail EHRs

QRDA Category 1 Validation

- Patient-level data

QRDA Category 3 Validation

- Aggregate-level data

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EP CQM CALCULATION TEST

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MU Stage 2 EP Test Deck

- **Draft version of the Cypress EP Test Data consists of 36 patients**
  - At least 2 DEN and 1 NUM patient for each of the 64 EP CQMs
  - Cypress is not testing all the Multi-Numerator permutations
  - Cypress is testing a portion of the Exclusion logic by including at least one path through each of the *Recommended Core* EP CQMs
  - Exception logic was not targeted at this time
- **Range is from 1 to 34 data points per patient**
- **This work and the patient records are currently being vetted by MU Stage 2 measure stewards**

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Measure Pathway Example

- **Sample mapping of a pathway through the *Cholesterol Screening – Risk* measure logic to the Cypress Test patient data on the right**

Population criteria

------ Population Criteria 1 ------ **<High Risk>**

- **Initial Patient Population 1 =** **<Patients are 20-80 years old at start of measurement period, plus encounter>**
  - AND: "Occurrence A of Encounter, Performed: Cholesterol Measure Encounter Codes" during "Measurement Period"
  - AND:
    - AND: "Patient Characteristic Birthdate: birth date" >= 20 year(s) starts before start of "Measurement Period"
    - AND: "Patient Characteristic Birthdate: birth date" < 80 year(s) starts before start of "Measurement Period"
- **Denominator 1 =**
  - AND: "Initial Patient Population 1"
  - AND: **<fasting LDL-C or a calculated LDL-C test>**
    - OR: "Laboratory Test, Performed: LDL Test" during "Measurement Period"
    - OR:
      - AND: "Laboratory Test, Performed: Total Cholesterol"
      - AND: "Laboratory Test, Performed: High Density Lipoprotein (HDL)"
      - AND: "Laboratory Test, Performed: Triglycerides"
      - during "Measurement Period"
  - AND:
    - OR: "Diagnosis, Active: CHD or CHD Risk Equivalent" starts before or during "Occurrence A of Encounter, Performed: Cholesterol Measure Encounter Codes" **<CHD or CHD Risk Equivalent>**
    - OR:

Cypress Test Patient data will be listed in this column:

- Patient has a cholesterol encounter
- Patient is 45 years old
- Patient has an LDL test
- Patient is diagnosed with CHD

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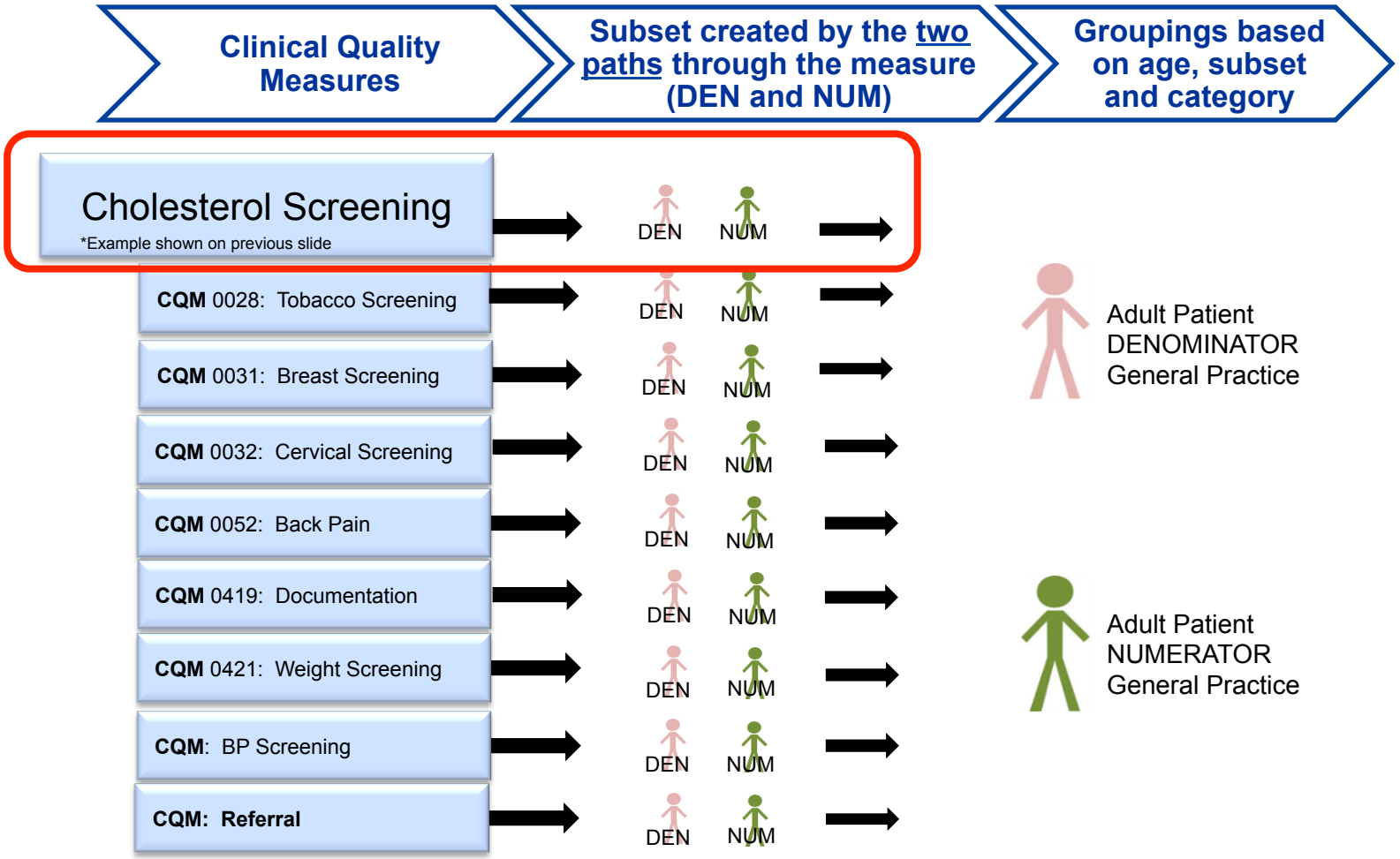
Measure Pathway Grouping Example



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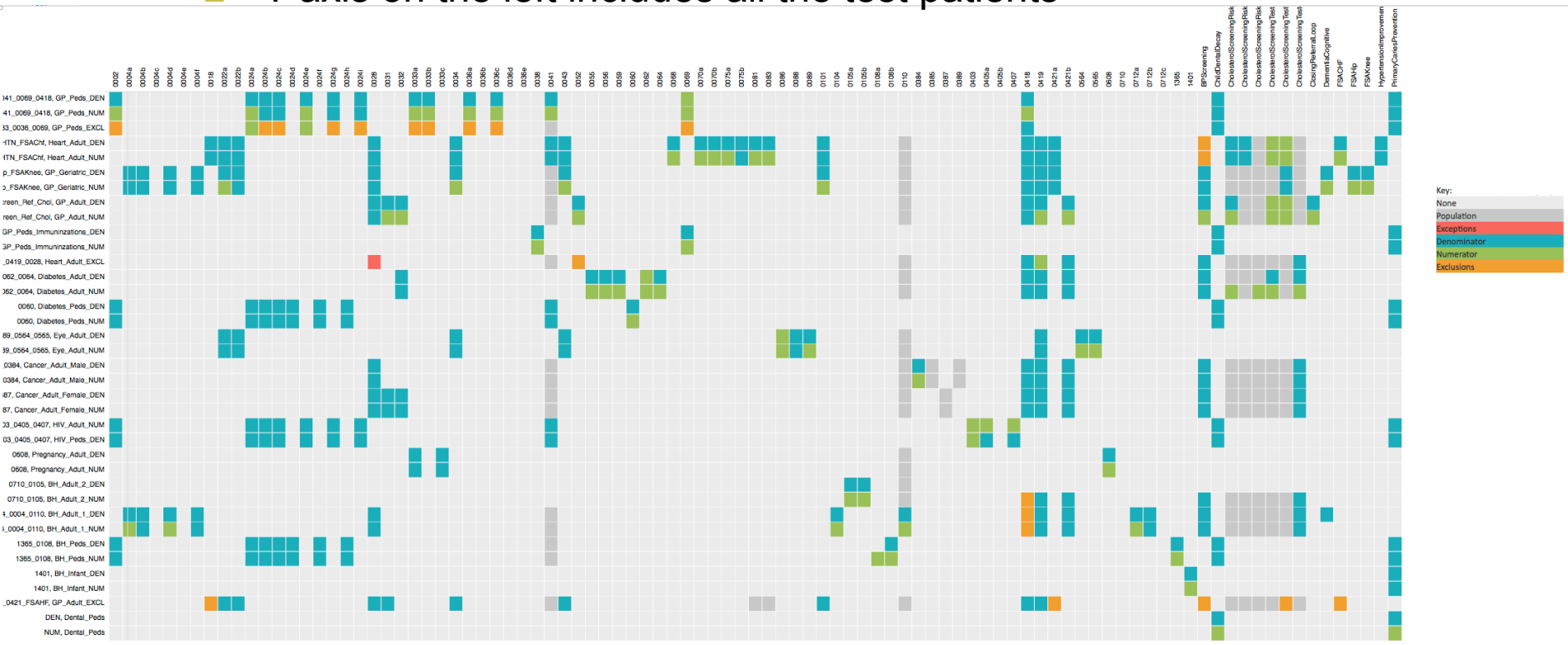
Cypress Test Data Alignment

- Below is a matrix of the Cypress MU Stage 2 EP Test Data applied against the MU EP CQM space
  - X-axis on the top includes all the MU CQMS
  - Y-axis on the left includes all the test patients



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Measure Selection

- Measures selected by vendor will determine which patients to use… assume these 3 EP CQMs are selected

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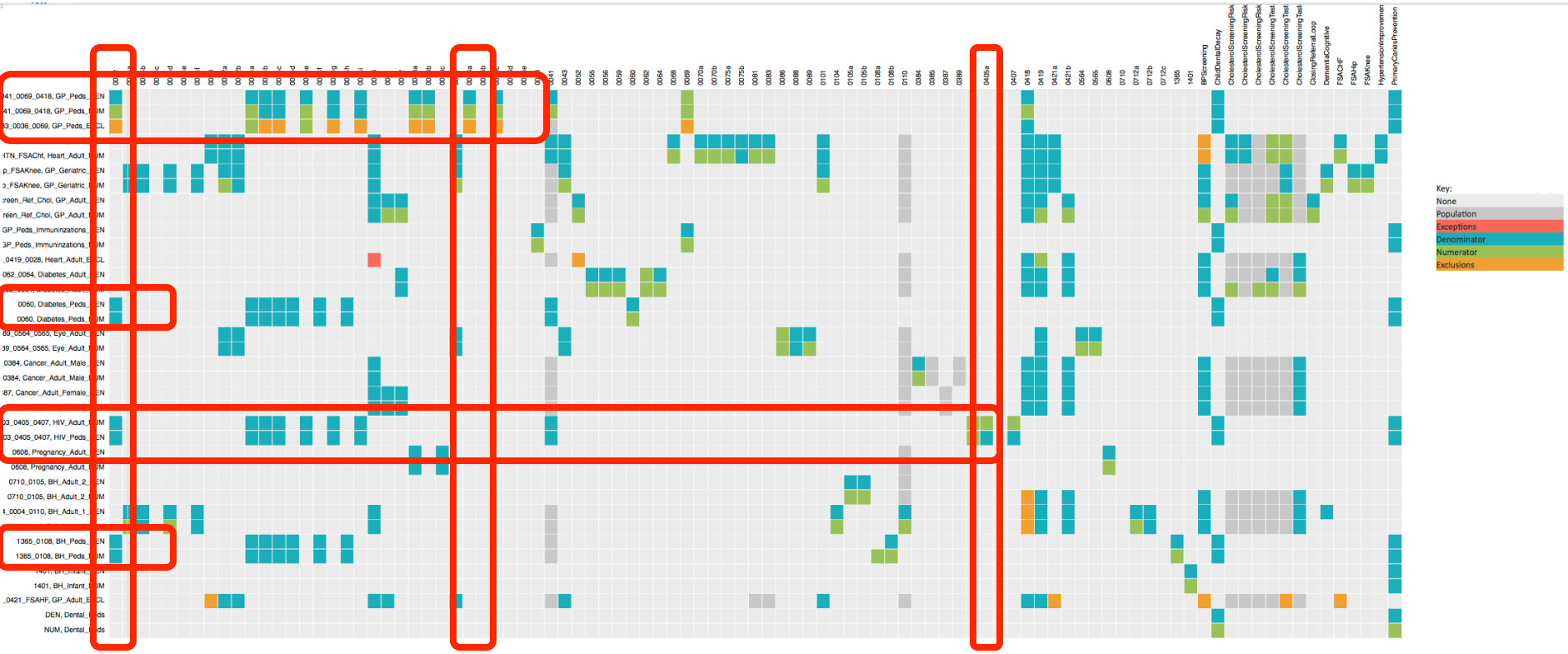
Patient Identification

- Cypress will identify 9 patients that can exercise numerator/ denominator and some exclusion for the 3 CQMs



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Patient Matching

- When possible, Cypress will remove additional patients if other patients can provide more coverage and still have 1 numerator and 2 denominator matches

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Final Test Patients

- These 5 patients can now provide a minimal test to exercise the 3 selected EP CQMs

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Testing Randomization

- **Guarding against gamesmanship with randomization**
  - Cypress will introduce some variability and randomness by “cloning” a patient that meets numerator logic for each CQM
  - Final randomization for EP Data will be ready for January release
    - Random removal of conditions/encounters/medications/etc. from “cloned” patient
    - Random modification of values like blood pressure (BP)/labs from “cloned” patient
  - Cypress v2 Quality Measure Engine (QME) software is key to this recalculation of randomized data
    - Machine executable logical code driven from the Healthcare Quality Measure Format (HQMF) definitions of the EP CQMs on CMS site
    - Capable of recalculating expected results for any of the EP CQMs
    - Capable of calculating results for any part of the EP CQMs

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EH TEST DATA

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MU Stage 2 EH Test Deck

- **Requires manual inspection of the 29 EH CQMs by MITRE staff and measure stewards**
- **Draft version of the EH Test Data currently consists of 20 patients covering 29 measures**
  - At least 2 DEN and 1 NUM patient per measure
- **MITRE is currently reviewing to verify results of test data to the EH measures as well as updating patients according to any logic changes**
  - EH measures have less overlap in the populations than the EP measures
  - Result is a higher patient to measure ratio in the EH deck just to test denominator and numerator pathways
- **EH CQM testing will not be dynamic/random until April 2013 because the Quality Measure Engine will not be enhanced to support non numerator/denominator CQM calculation**

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QRDA CATEGORY 1 TEST DATA

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QRDA Category 1 Test Data

- Cypress presents a single patient record to fully exercise all clinical attributes in a CQM for generation of a single QRDA Category 1 XML document
- These patient records represent all the clinical attributes which could be used for a CQM, and are not designed to be realistic patient records

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TESTING AND PILOTS

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Cypress v2 Testing and Pilots

- Cypress v2 Beta Pilots
  - Require both ATL **and** EHR vendor
  - Meant to test both workflow but also maturity of Cypress software
  - Ideally, pilots start early December 2012
  - EHR vendor readiness for December and MU Stage 2 CQMs and data standards is a risk to this plan
    - ATL feedback is welcome on this plan

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EP TEST SCREENSHOTS

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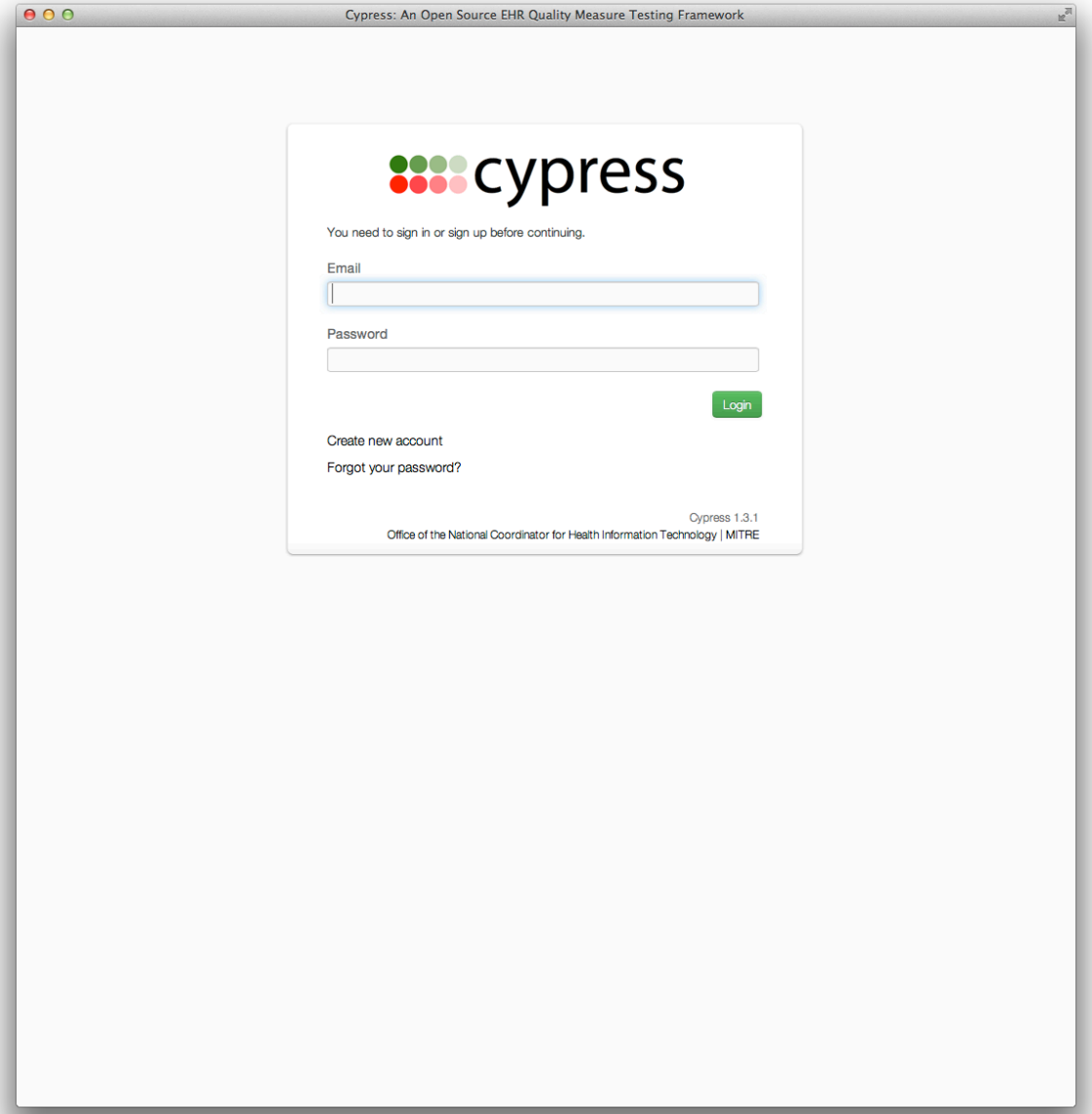

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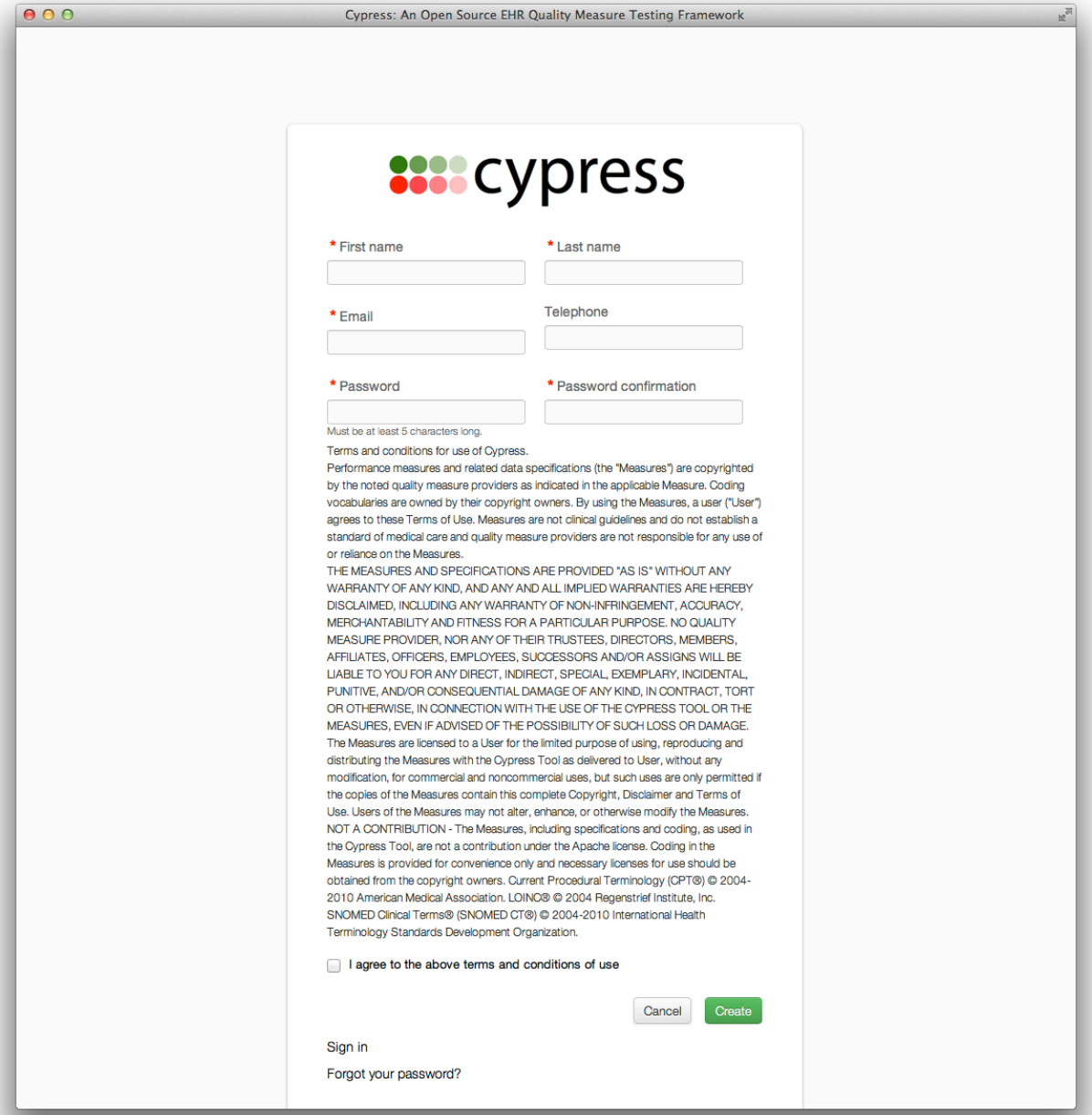

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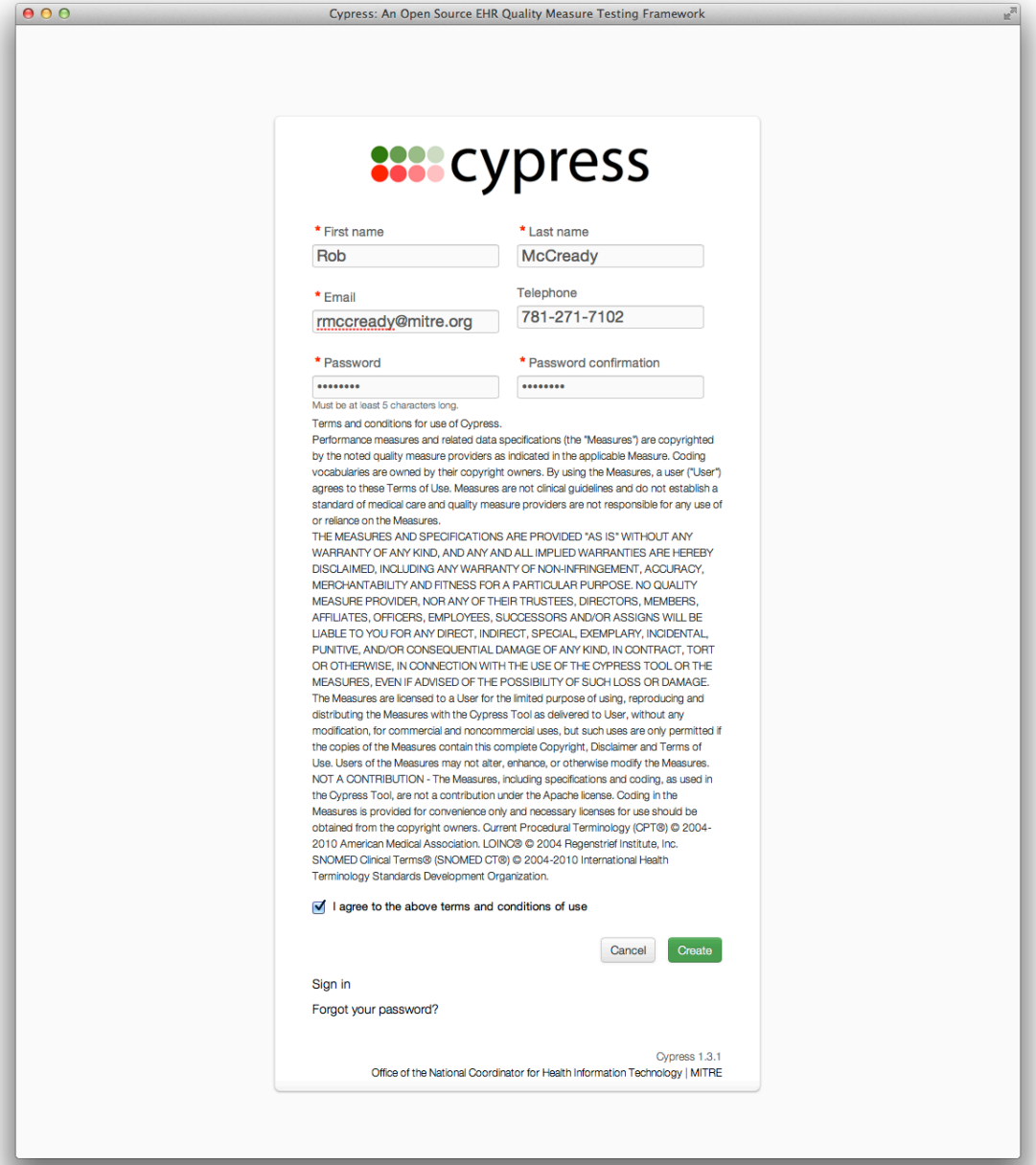

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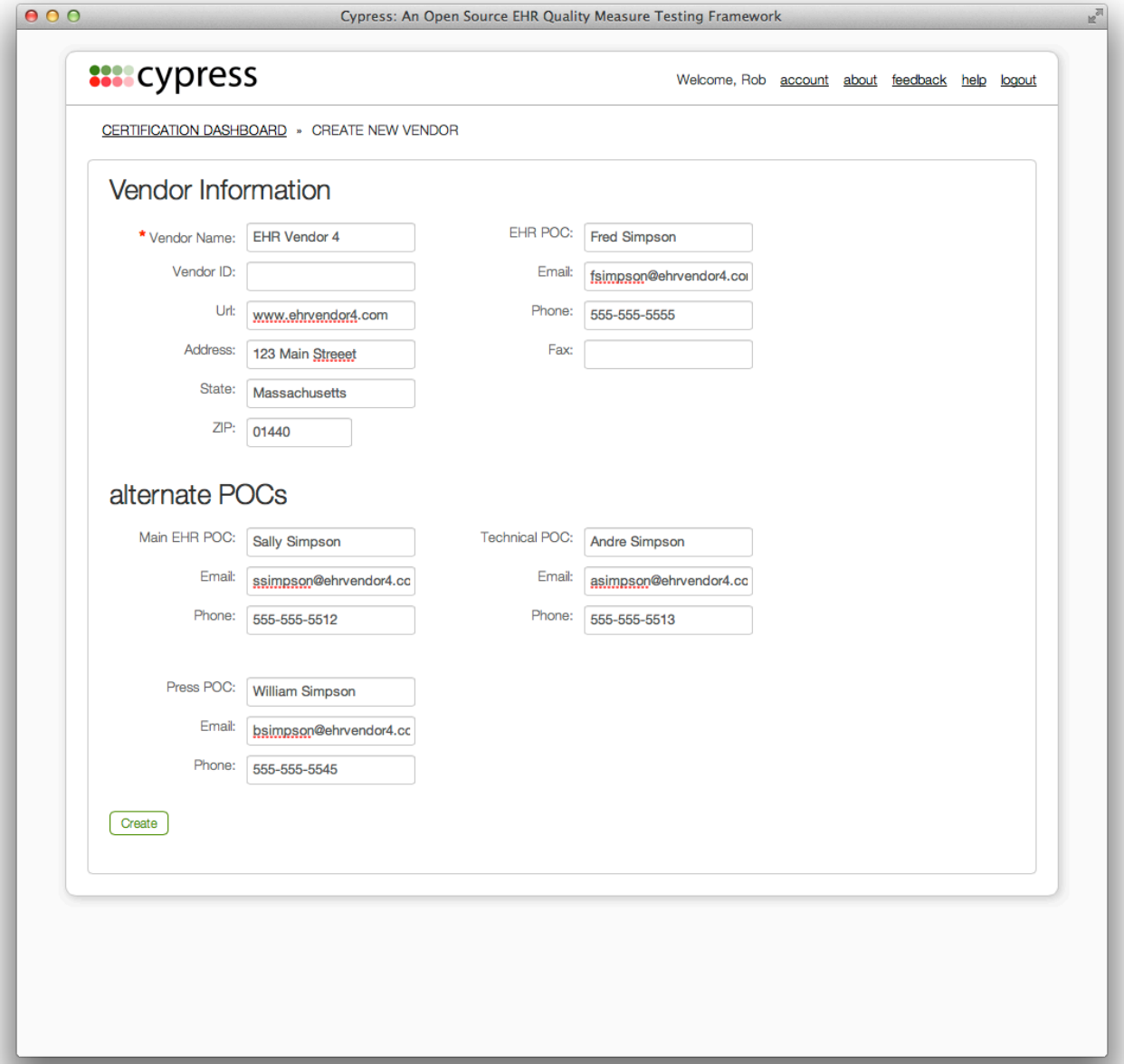

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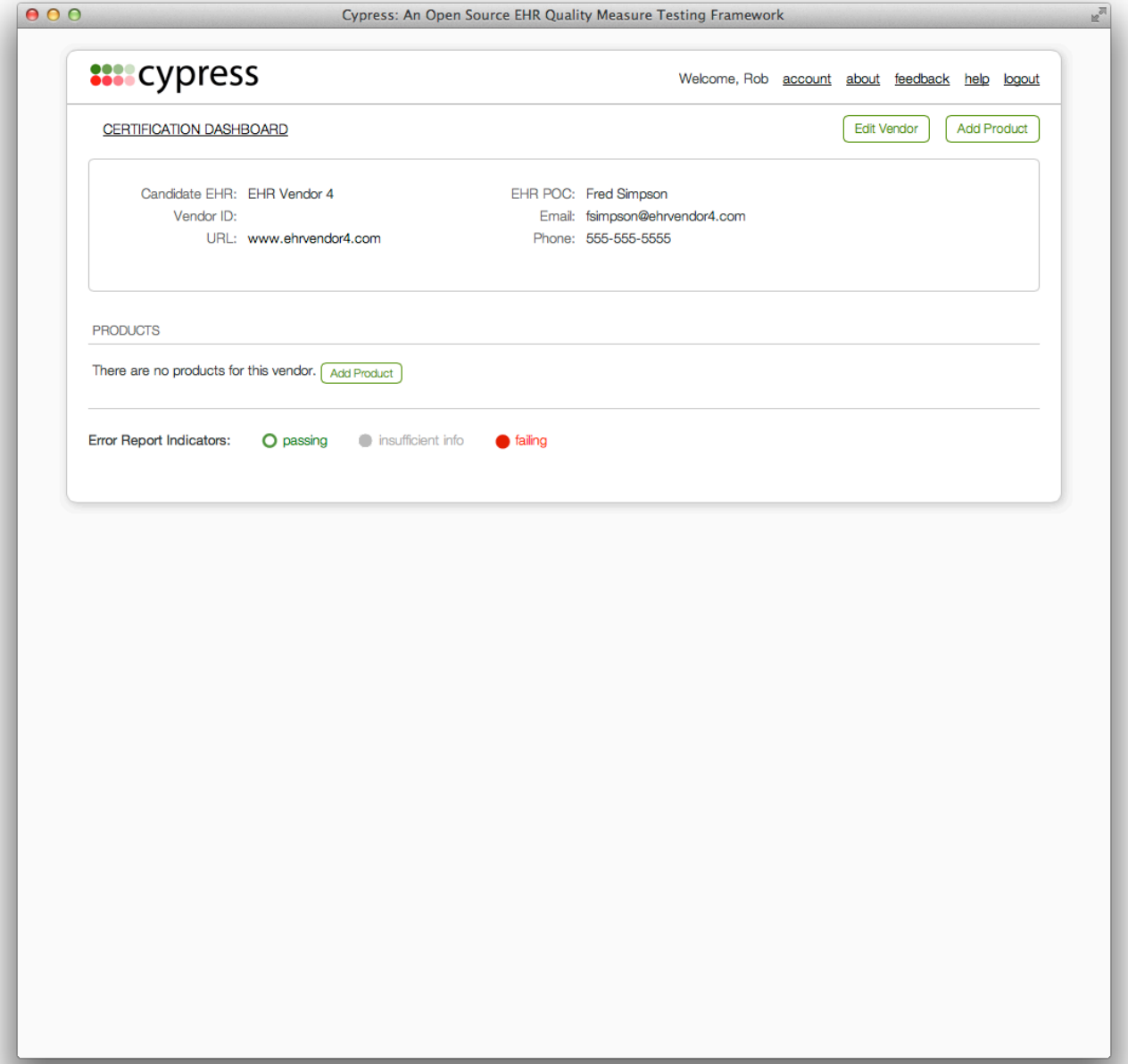

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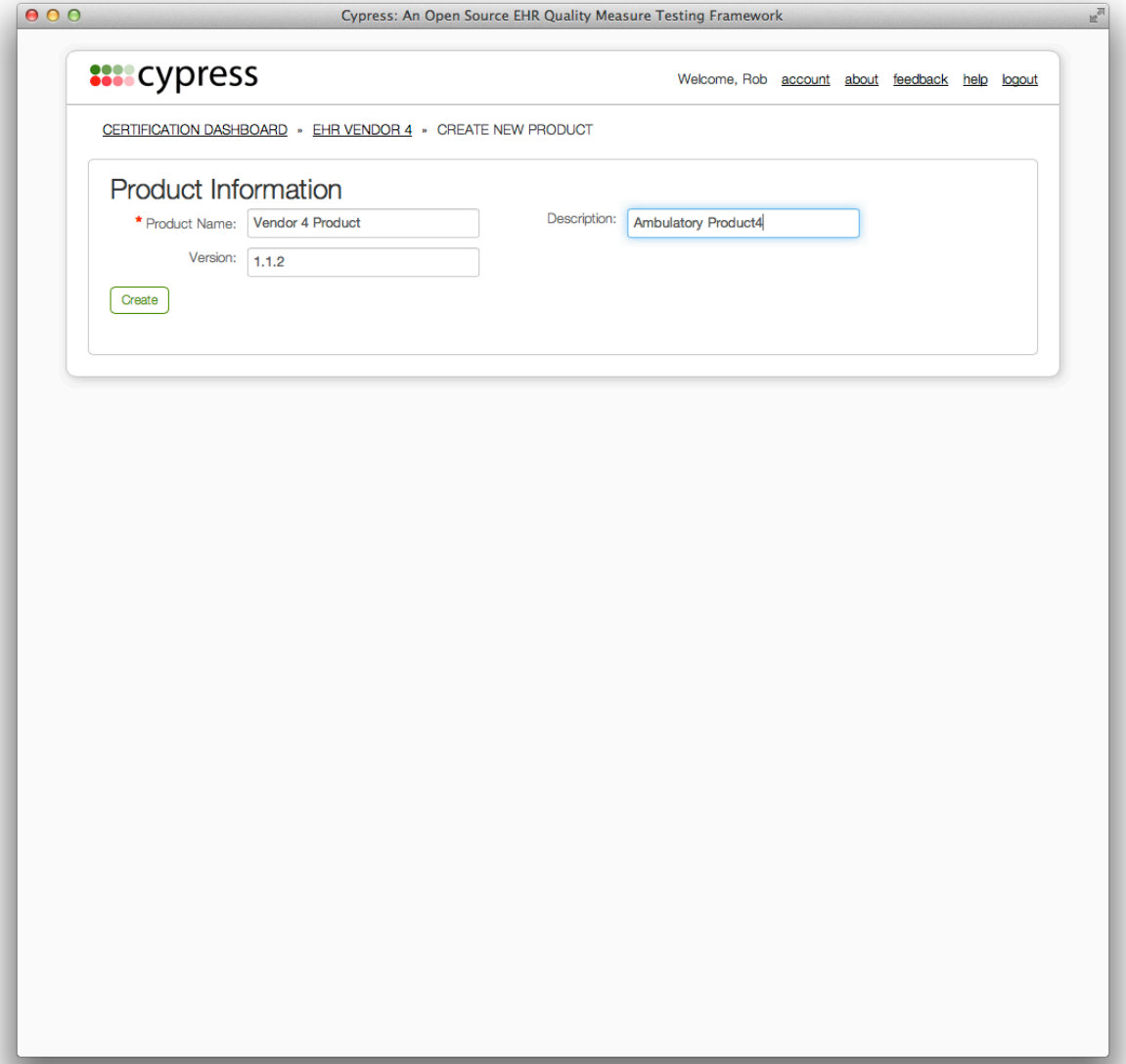

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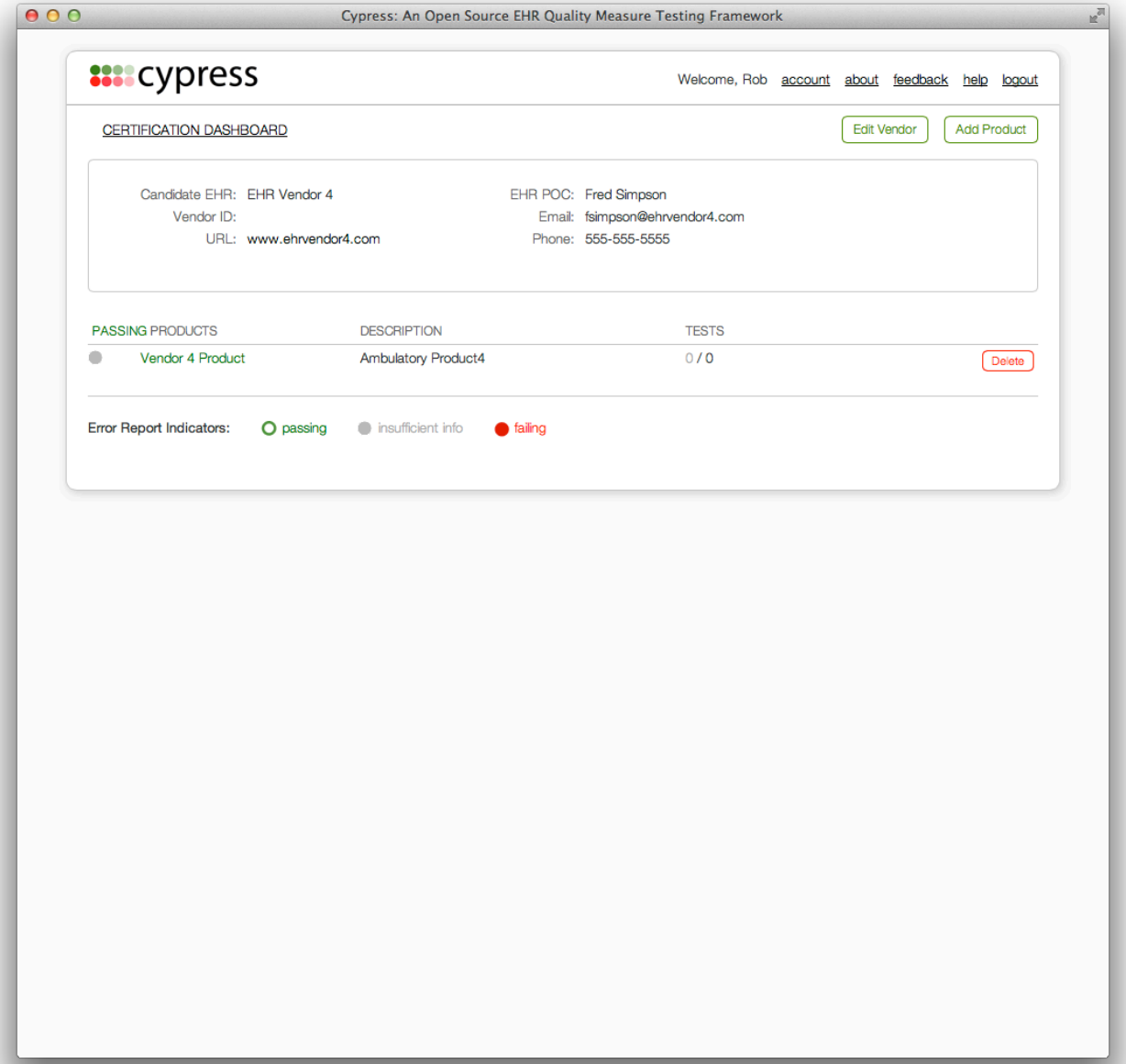

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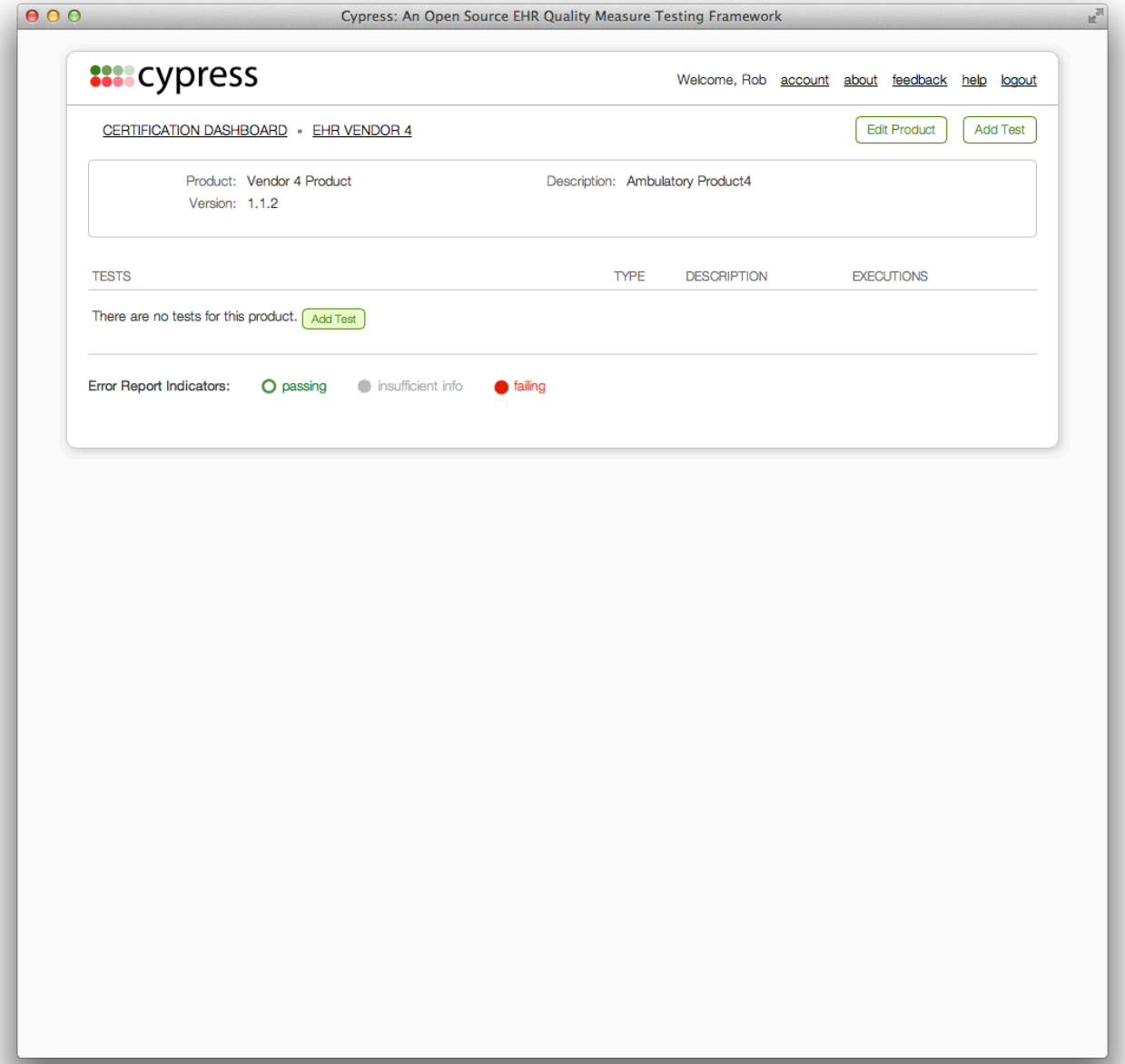

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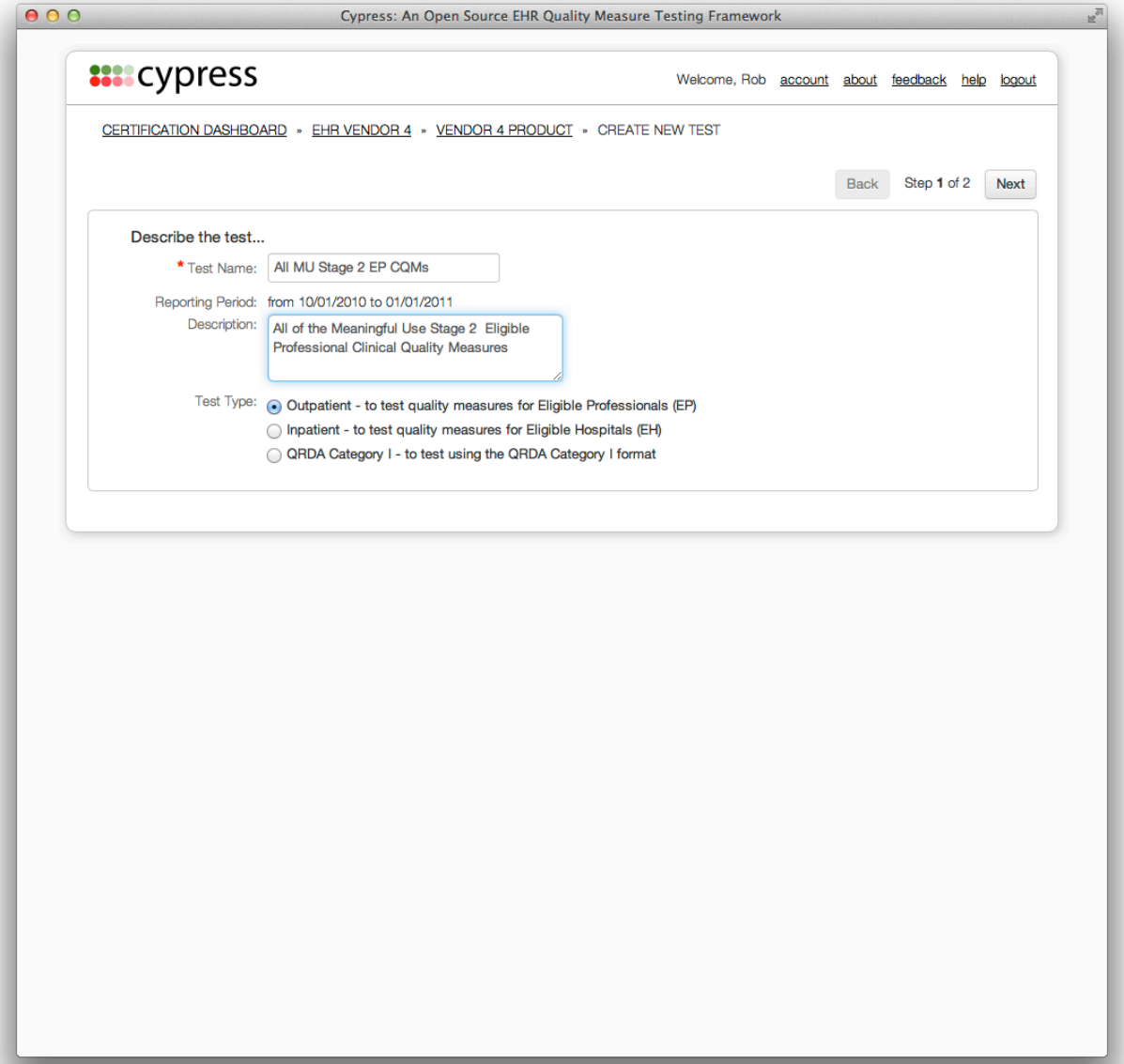

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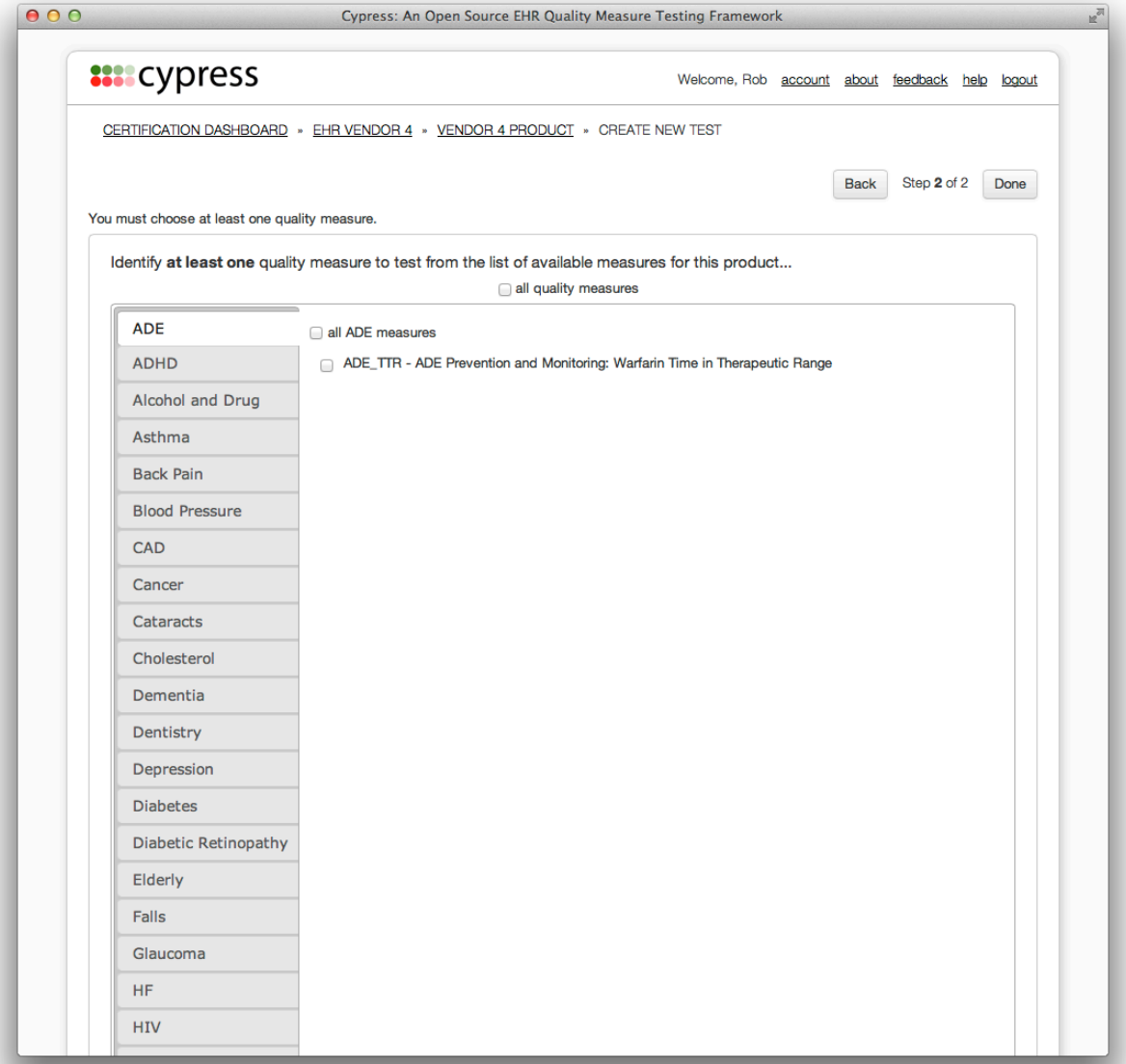

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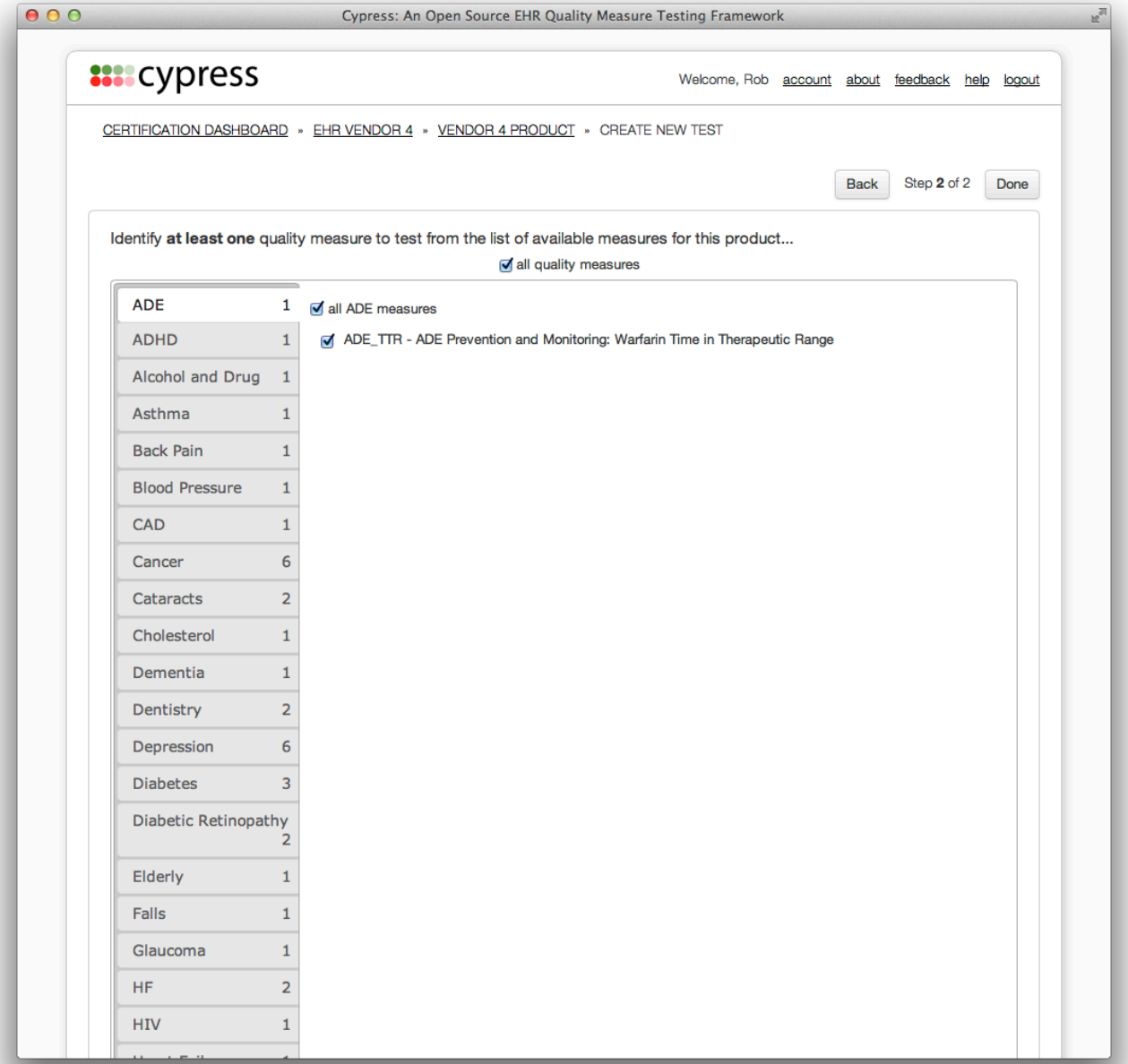

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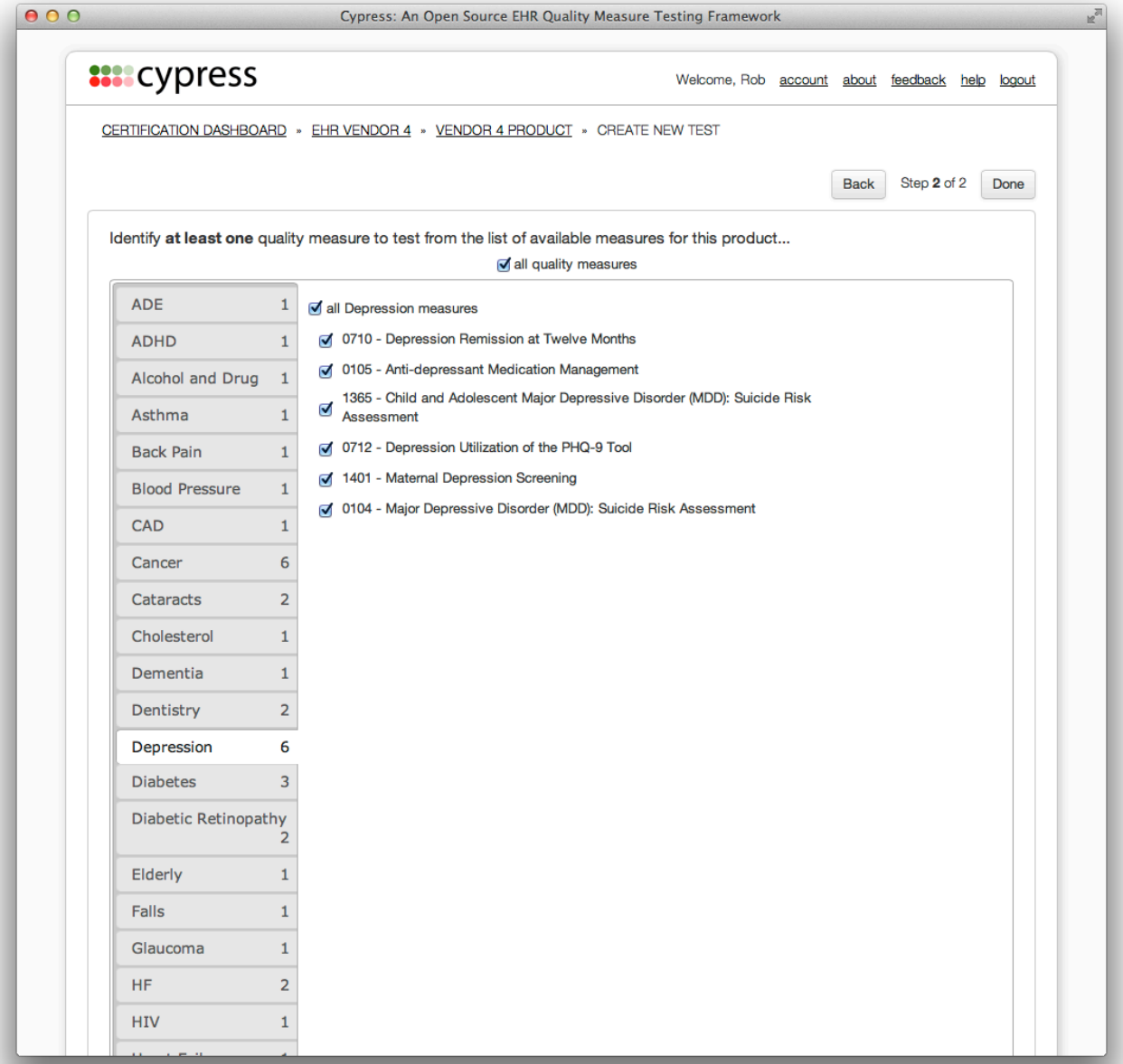

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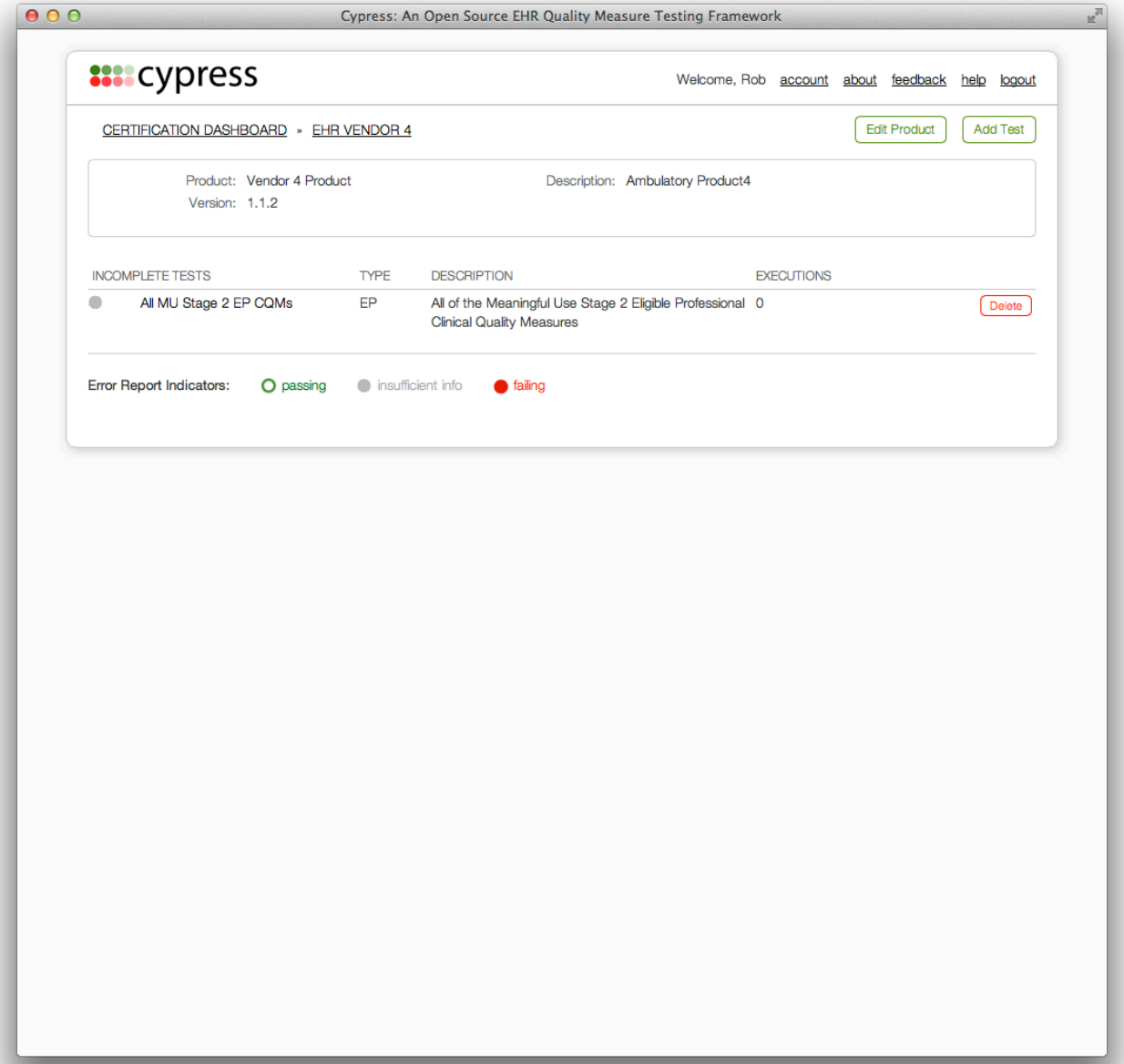

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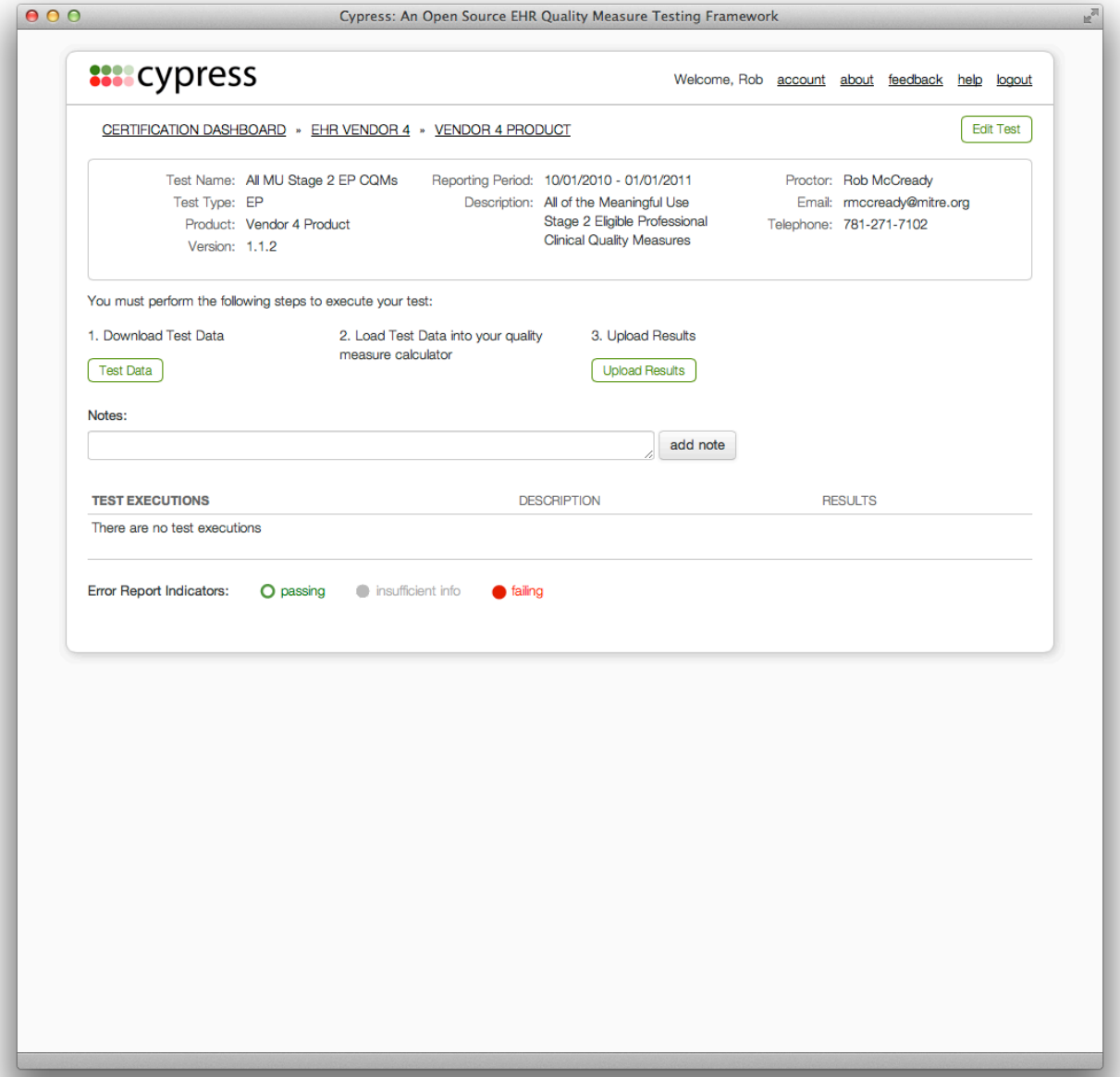

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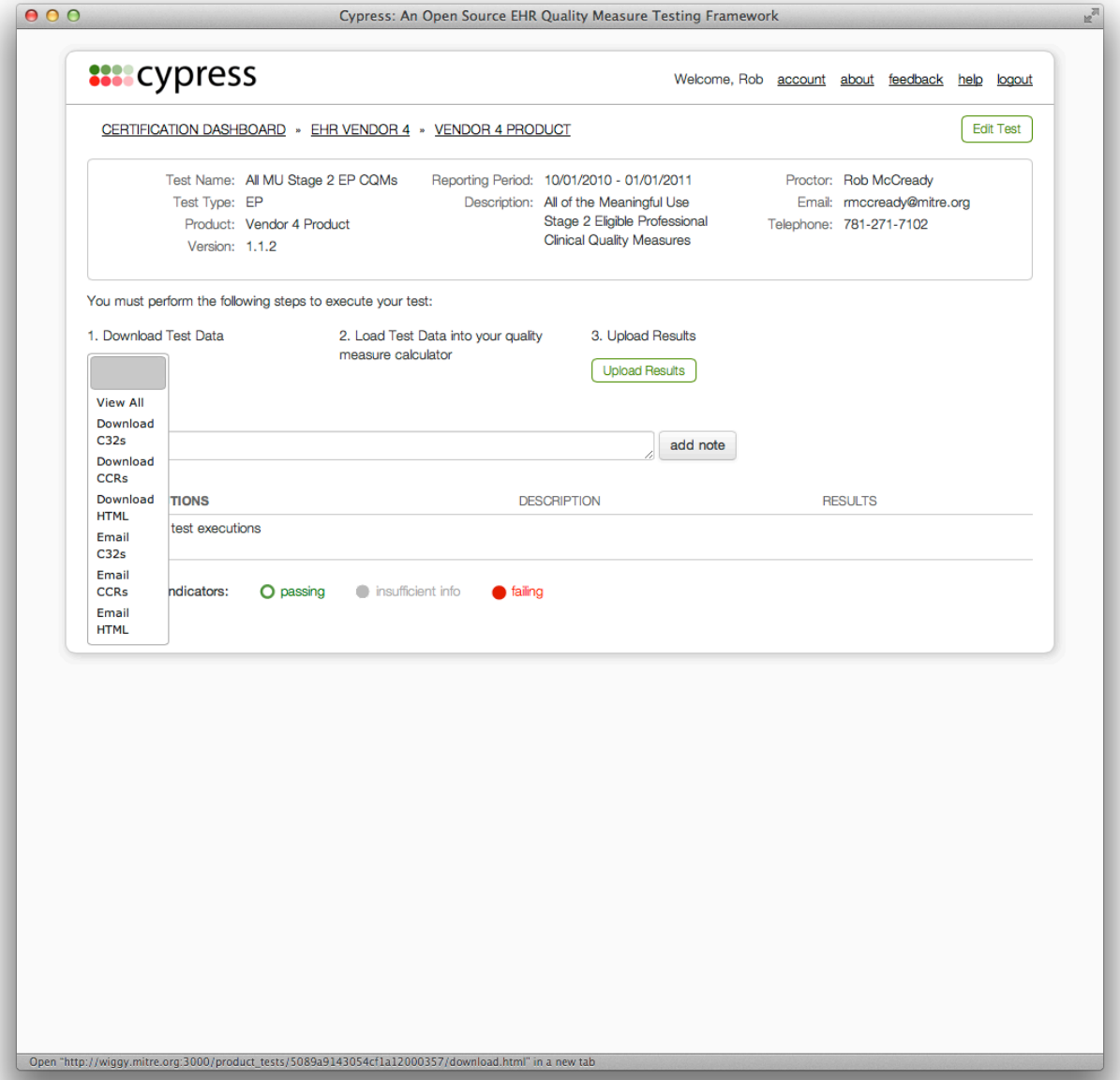

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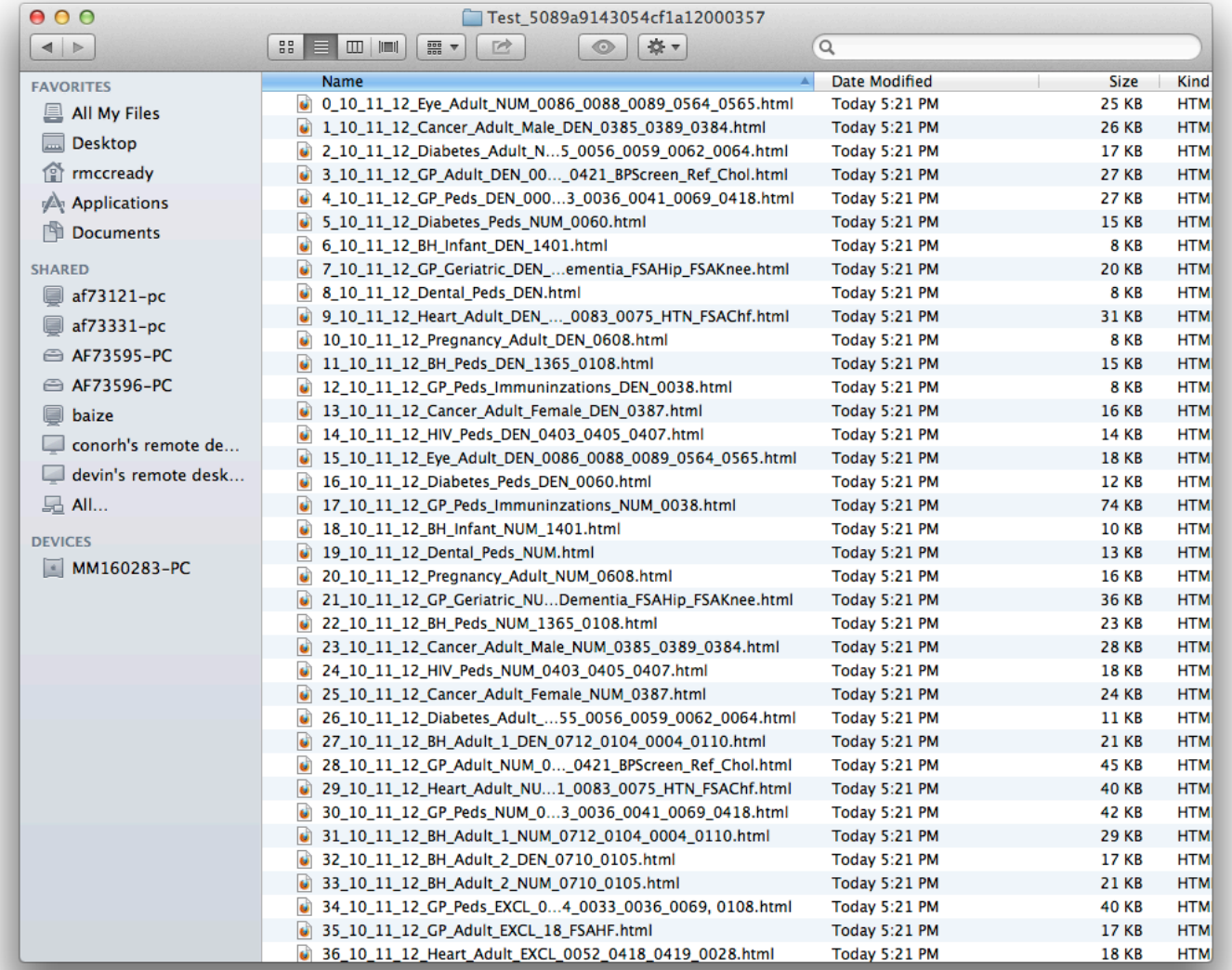

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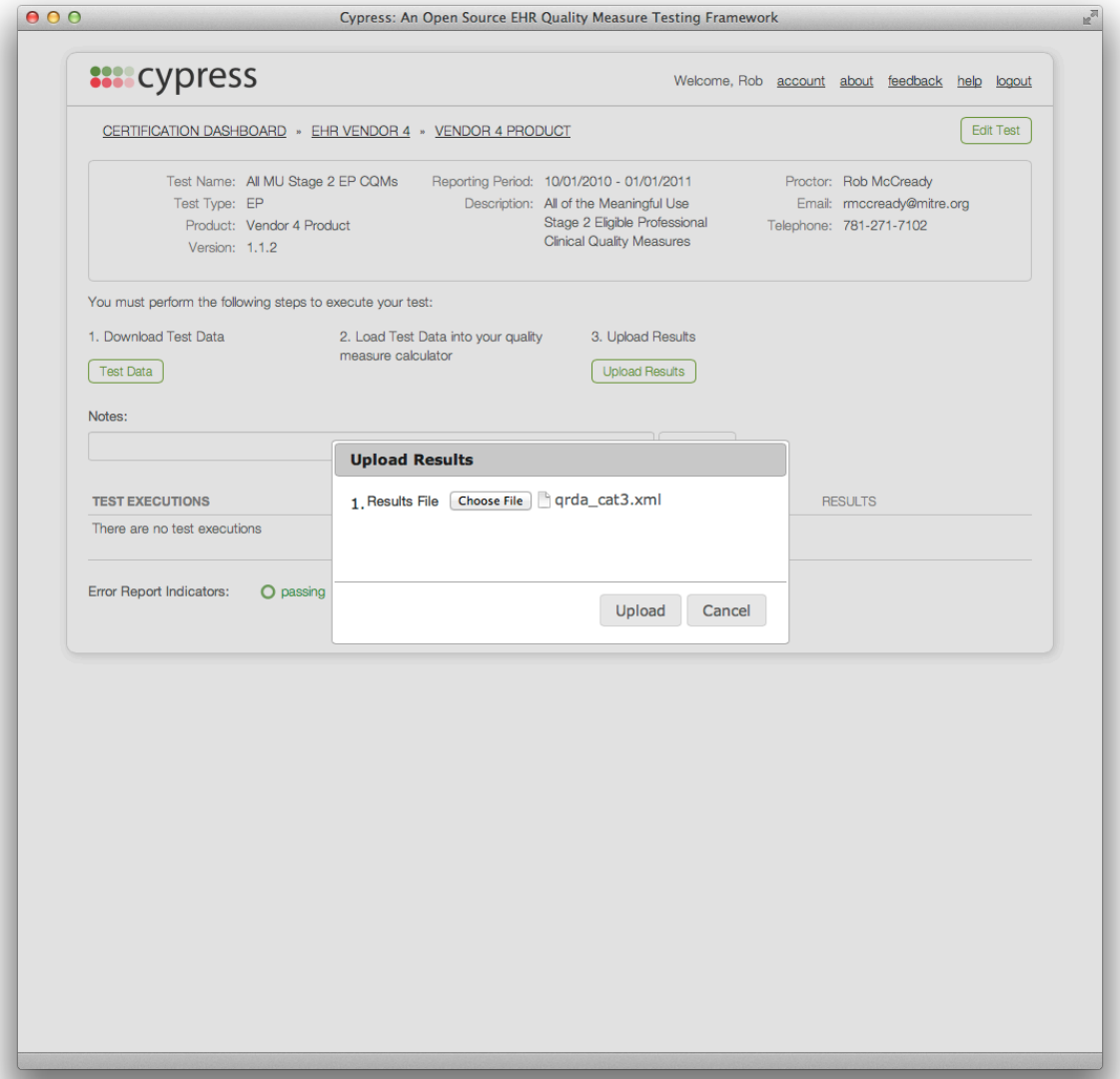

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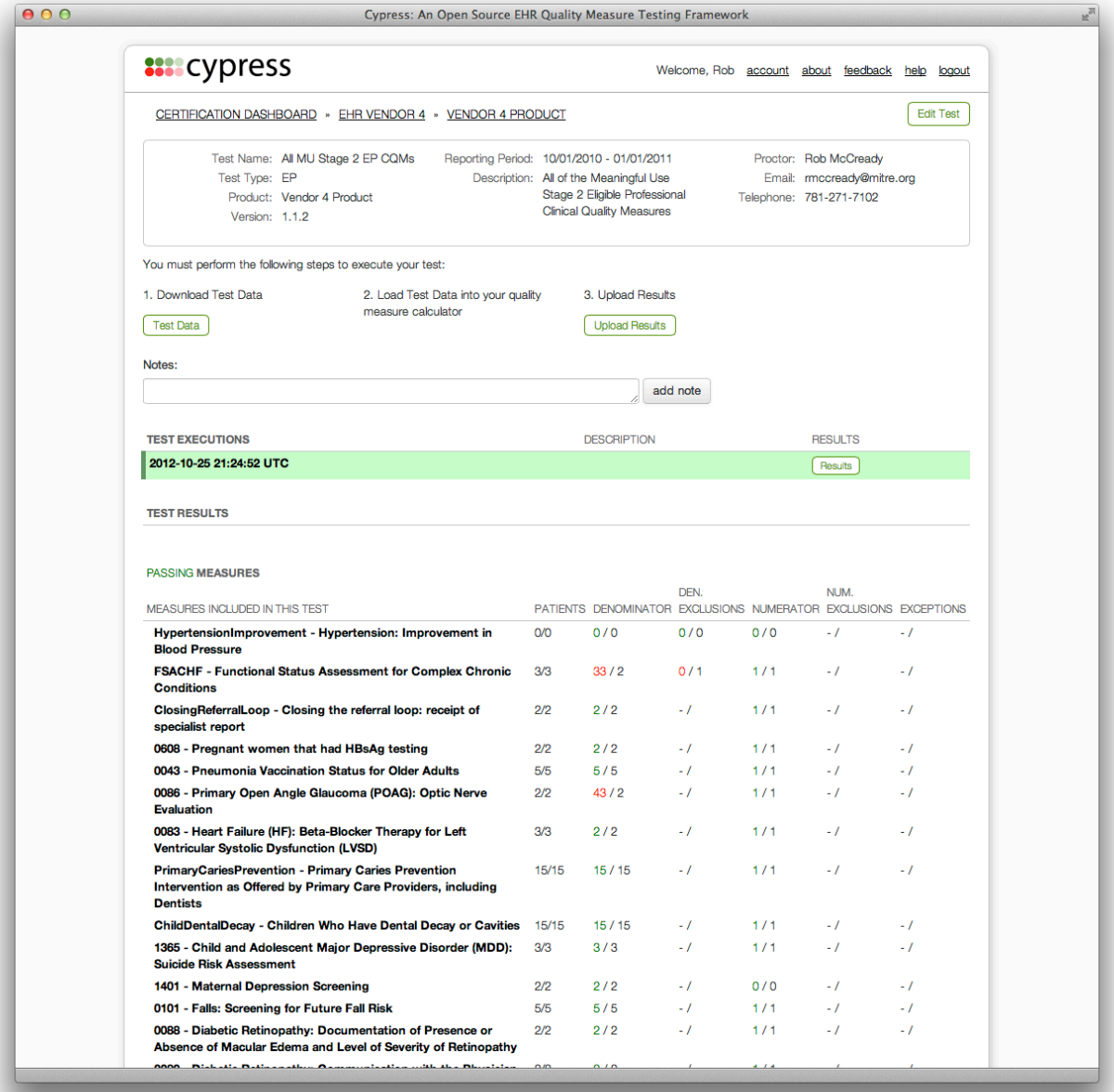

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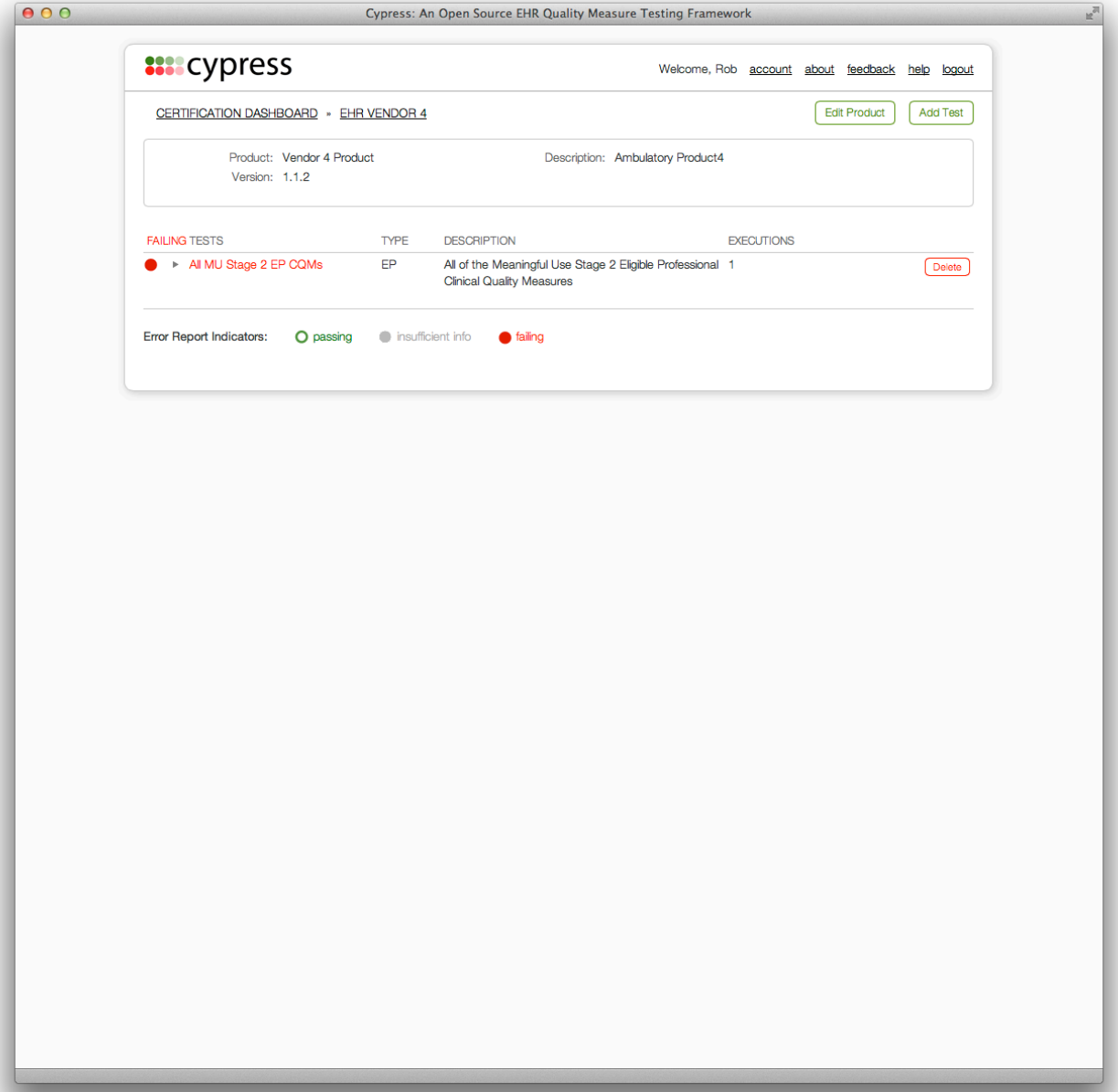

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